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TITLE: OPTICAL TRANSPORT SYSTEM

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DATE: March 29, 2001

Assistant Director for Patents
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PRELIMINARY AMENDMENT

Sir:

Prior to the initial examination, please amend the above-identified application as follows:

IN THE SPECIFICATION:

After the title of the invention, please insert:

-- This application is a continuation-in-part of U.S. patent application Serial No 08/831,375 filed April 1, 1997, now U.S. Patent No. 5,901,260. --

IN THE CLAIMS:

Please add new claims 19 to 85.

19. A bi-directional optical transport system for passing optical signals, comprising:

an optical bus for permitting bi-directional transmission of the optical signals;

an electrical-to-optical converter for converting electrical communication signals received from first terminal equipment into optical communication signals;

a first passive optical interface device coupled to the optical bus for routing the optical communication signals received from the electrical-to-optical converter onto the optical bus in both directions and for permitting the optical signals traveling along the optical bus to pass by in both directions;

a second passive optical interface device coupled to the optical bus for routing the optical communication signals traveling along the bus to an optical-to-electrical converter and for permitting the optical signals traveling along the optical bus to pass by in both directions;

an optical amplifier for performing bi-directional amplification of the optical signals; and

the optical-to-electrical converter for receiving the optical communication signals from the second passive optical interface device and for converting the optical communication signals into the electrical communication signals, the optical-to-electrical converter for providing the electrical communication signals to second terminal equipment.

20. The optical transport system as set forth in claim 19, wherein the optical bus comprises a fiber optic line.

21. The optical transport system as set forth in claim 20, further comprising a second fiber optic line wherein the second fiber optic line is a redundant optical bus.

22. The optical transport system as set forth in claim 19, wherein the optical bus is a broken ring.

23. The optical transport system as set forth in claim 19, further comprising a second optical-to-electrical converter for converting optical signals, received from the first passive optical interface device over the optical bus, into electrical signals.

24. The optical transport system as set forth in claim 23, wherein the second optical-to-electrical converter is for providing the electrical signals to the first terminal equipment.

25. The optical transport system as set forth in claim 23, wherein the second optical-to-electrical converter is for providing the electrical signals to third terminal equipment.

26. The optical transport system as set forth in claim 19, further comprising a second electrical-to-optical converter for converting second electrical communication signals into second optical communication signals and for providing the second optical communication signals to the second passive optical interface device, the second passive optical interface device for routing the second optical communication signals received from the second electrical to-optical converter onto the optical bus in both directions.

27. The optical transport system as set forth in claim 19, wherein the optical amplifier comprises a fiber amplifier.

28. The optical transport system as set forth in claim 27, wherein the fiber amplifier comprise a rare earth doped fiber amplifier.

29. The optical transport system as set forth in claim 27, further comprising a pump source for emitting an excitation light received by the optical amplifier.

30. The optical transport system as set forth in claim 19, wherein the optical amplifier is located along the optical bus.

31. The optical transport system as set forth in claim 19, wherein the optical amplifier is located between the electrical-to-optical converter and the first passive optical interface device.

32. The optical transport system as set forth in claim 19, wherein the optical amplifier is located between the second passive optical interface device and the optical-to-electrical converter.

33. The optical transport system as set forth in claim 19, wherein the optical communication signals and optical signals are wavelength division multiplexed and the second passive optical interface device includes a wavelength division multiplexer.

34. The optical transport system as set forth in claim 19, wherein the first and second passive optical interface devices comprise taps for diverting a fraction of the optical signals and optical communication signals to the optical-to-electrical converter.

35. The optical transport system as set forth in claim 19, wherein the second passive optical interface device comprises a tunable filter for filtering the optical communication signals from the optical signals on the bus.

36. The optical transport system as set forth in claim 19, wherein the second passive optical interface device includes a filter for filtering the optical communication signals from the optical signals on the bus.

37. The optical transport system as set forth in claim 19, wherein the electrical-to-optical converter comprises a directly modulated optical source.

38. The optical transport system as set forth in claim 19, wherein the optical-to-electrical converter generates the electrical signals in Mil_Std 1553 protocol.

39. The optical transport system as set forth in claim 19, wherein the optical-to-electrical converter generates the electrical signals in ARINC 429 protocol.

40. The optical transport system as set forth in claim 19, wherein the electrical communication signals comprise tri-level electrical signals, the optical signals comprise bi-level optical signals, the electrical-to-optical converter converts the tri-level electrical signals into bi-level optical signals, and the optical-to-electrical converter converts the bi-level optical signals into the tri-level electrical signals.

41. The optical transport system as set forth in claim 19, further comprising the first terminal equipment.

42. The optical transport system as set forth in claim 41, wherein the first terminal equipment comprises video equipment and the electrical communication signals comprise video signals.

43. The optical transport system as set forth in claim 41, wherein the first terminal equipment comprises a sensor and the electrical communication signals comprise data signals.

44. The optical transport system as set forth in claim 19, wherein the electrical communication signals comprise radio frequency signals.

45. The optical transport system as set forth in claim 19, wherein the electrical communication signals comprise Ethernet signals.

46. The optical transport system as set forth in claim 19, wherein the electrical communication signals comprise digital signals.

47. The optical transport system as set forth in claim 19, wherein the electrical communication signals comprise analog signals.

48. The optical transport system as set forth in claim 19, wherein the electrical communication signals comprise discrete signals.

49. The optical transport system as set forth in claim 41, wherein the first terminal equipment comprises an input device and the electrical communication signals comprise control signals.

50. The optical transport system as set forth in claim 41, wherein the first terminal equipment comprises a workstation.

51. The optical transport system as set forth in claim 41, further comprising a translation logic device connected between the first terminal equipment and the first passive optical interface device for performing protocol translation.

52. The optical transport system as set forth in claim 19, further comprising the second terminal equipment.

53. The optical transport system as set forth in claim 19, wherein the optical bus forms a ring topology.

54. The optical transport system as set forth in claim 19, wherein the electrical-to-optical converter comprises a tuneable laser.

55. A structure equipped with an optical transport system enabling optical communications over an optical bus, comprising:

the structure;

the optical bus for permitting bi-directional transmission of the optical signals, wherein the optical bus is contained at least in part within the structure;

first terminal equipment located within the structure for generating electrical communication signals;

an electrical-to-optical converter located within the structure for converting the electrical communication signals received from the first terminal equipment into optical communication signals;

a first passive optical interface device located within the structure and coupled to the optical bus for routing the optical communication signals received from the electrical-to-optical converter onto the optical bus in both directions and for permitting the optical signals traveling along the optical bus to pass by in both directions;

an optical amplifier located within the structure for performing bi-directional amplification of the optical signals;

a second passive optical interface device located within the structure and coupled to the optical bus for routing the optical communication signals traveling along the bus to an optical-to-electrical converter and for permitting the optical signals traveling along the optical bus to pass by in both directions;

the optical-to-electrical converter for receiving the optical communication signals from the second passive optical interface device and for converting the optical communication signals into the electrical communication signals; and

second terminal equipment located within the structure for receiving electrical communication signals from the optical-to-electrical converter.

56. The structure as set forth in claim 55, wherein the structure comprises a vehicle.

57. The structure as set forth in claim 55, wherein the structure comprises avionics.

58. A method for transporting optical signals over an optical bus between first and second nodes, comprising:

generating electrical communication signals at a first node;

converting the electrical communication signals into optical communication signals;

passively splitting the optical communication signals into two components;

routing the two components of the optical communication signals at a first location along the optical bus and permitting the optical signals already on the optical bus traveling in both directions to be passively routed pass the first location, the routing involving directing the two components of the optical communication signals in opposite directions along the optical bus and combining the two components with any optical signals already on the optical bus;

at a second location along the optical bus, passively diverting at least some of the optical signals on the bus traveling in both directions toward a second node, wherein the diverting includes permitting the optical signals traveling in both directions to be passively routed pass the second location;

converting the optical signals diverted toward the second node into corresponding electrical signals, with the electrical signals including the electrical communication signals generated at the first node; and

amplifying the optical signals traveling in both directions between the first node and the second node, wherein the amplifying is performed passively and is for compensating for at least some of the losses associated with diverting the optical signals toward the second node.

59. The method as set forth in claim 58, further comprising:

generating second electrical communication signals at the second node;

converting the second electrical communication signals into second optical communication signals;

passively splitting the second optical communication signals into two components of the second optical communication signals;

routing the two components of the second optical communication signals at the second location along the optical bus and permitting the optical signals already on the optical bus traveling in both directions to be passively routed pass the second location, the routing involving directing the two components of the second optical communication signals in opposite directions along the optical bus and combining the two components of the second optical communication signals with any optical signals already on the optical bus; and

at a third location along the optical bus, passively diverting at least some of the optical signals on the bus traveling in both directions toward a third node, wherein the diverting includes permitting the optical signals traveling in both directions to be passively routed pass the third location.

60. The method as set forth in claim 59, wherein generating the second electrical communication signals at the second node and converting the optical signals diverted toward the second node into corresponding electrical signals occur simultaneously.

61. The method as set forth in claim 58, further comprising sending the corresponding electrical communication signals to terminal equipment.

62. The method as set forth in claim 61, wherein sending comprises sending the corresponding electrical communication signals to a plurality of terminal equipment.

63. The method as set forth in claim 61, wherein sending comprises sending the corresponding electrical communication signals to a translation logic device.

64. The method as set forth in claim 61, wherein sending comprises sending the corresponding electrical communication signals to a plurality of translation logic devices.

65. The method as set forth in claim 58, wherein passively diverting at the second location comprises selecting optical signals at a set of wavelengths.

66. The method as set forth in claim 58, wherein passively diverting at the second location comprises diverting a fraction of the optical signals at all wavelengths.

67. The method as set forth in claim 58, wherein passively diverting at the second location comprises selectively tuning a filter to a desired wavelength to select optical signals at that desired wavelength.

68. The method as set forth in claim 58, further comprising providing a back up optical bus.

69. A method of transporting optical signals between nodes, comprising:

providing a bi-directional optical bus, the bi-directional optical bus permitting bi-directional communication between any of the nodes;

passively diverting at least part of the optical signals traveling along the bus in both directions toward each node;

converting electrical signals generated at any of the nodes into converted optical signals;

separating the converted optical signals into two components and passively combining the two components of the converted optical signals with the optical signals traveling in both directions along the optical bus, wherein the passively combining involves directing the two components of the converted optical signals in opposite directions along the optical bus;

receiving at each node at least part of the optical signals traveling along the optical bus;

at the nodes, converting the received optical signals back into corresponding the electrical signals; and

providing passive amplification of the optical signals traveling along the optical bus, the passive amplification being bi-directional and compensating at least for some of the losses associated with passively diverting the optical signals to each node;

wherein by passively diverting optical signals from the optical bus to each node and by passively combining the two components of converted optical signals from each node onto the optical bus, each node can transmit optical signals to any other node and also receive optical signals from any other node.

70. The method as set forth in claim 69, further comprising operating at least some of the nodes in full duplex such that each node can simultaneously transmit optical signals and at the same receive optical signals from another node.

71. The method as set forth in claim 69, wherein receiving at each node at least part of the optical signals traveling along the optical bus comprises selecting optical signals having only certain wavelengths.

72. The method as set forth in claim 69, wherein receiving at each node at least part of the optical signals traveling along the optical bus comprises filtering out a group of the optical signals.

73. The method as set forth in claim 69, wherein receiving at each node at least part of the optical signals traveling along the optical bus comprises wavelength division multiplexing the optical signals on the bus.

74. The method as set forth in claim 69, further comprising providing a back up bi-directional optical bus.

75. An optical transport system enabling optical communications between terminal equipment, comprising:

an optical bus for permitting bi-directional transmission of the optical signals;

first terminal equipment for generating electrical communication signals;

an electrical-to-optical converter for converting the electrical communication signals received from the first terminal equipment into optical communication signals;

a first passive optical interface device coupled to the optical bus at a first location for routing the optical communication signals received from the electrical-to-optical converter onto the optical bus in both directions and for permitting the optical signals traveling along the optical bus to pass by in both directions;

a second passive optical interface device coupled to the optical bus at a second location for routing the optical communication signals traveling along the bus to at least one optical-to-electrical converter and for permitting the optical signals traveling along the optical bus to pass by in both directions;

at least one optical-to-electrical converter for receiving the optical communication signals from the second passive optical interface device and for converting the optical communication signals into the electrical communication signals;

a plurality of terminal equipment for receiving the electrical communication signals from the at least one optical-to-electrical converter; and

an optical amplifier for performing bi-directional amplification of the optical signals;

wherein electrical communication signals from first terminal equipment is transmitted over the bi-directional optical bus and can be received by at least one of the plurality of terminal equipment.

76. The optical transport system as set forth in claim 75, wherein the system includes a plurality of optical-to-electrical converters, each receiving the optical communication signals from the second passive optical interface device.

77. The optical transport system as set forth in claim 76, wherein the plurality of terminal equipment receive the electrical communication signals from a respective one of the plurality of optical-to-electrical converters.

78. The optical transport system as set forth in claim 75, wherein the plurality of terminal equipment receive the electrical communication signals from the one optical-to-electrical converter.

79. An optical system for communicating with at least one other system over a bi-directional optical bus, comprising:

an optical transmitter for receiving a first set of electrical signals and for producing a first set of optical signals;

a passive optical interface device for being coupled to the optical bus for routing the

first set of optical signals received from the optical transmitter onto the optical bus in both directions and for permitting optical signals already traveling along the optical bus to pass by in both directions;

an optical receiver for receiving a second set of optical signals traveling along the optical bus from the passive optical interface device and for generating a second set of electrical signals; and

an optical amplifier for performing bi-directional amplification of at least one of the first set and second set of optical signals;

wherein the optical amplifier is for compensating for at least some of the coupling losses associated with the passive optical interface device.

80. The optical communication system as set forth in claim 79, wherein the optical amplifier is placed between the optical transmitter and the passive optical interface device and compensates for coupling losses associated with routing the first set of optical signals in both directions along the optical bus.

81. The optical communication system as set forth in claim 79, wherein the optical amplifier is placed between the optical receiver and the passive optical interface device and amplifies the second set of optical signals.

82. The optical communication system as set forth in claim 79, wherein the optical

amplifier is placed on the optical bus and is for amplifying the optical signals traveling along the optical bus.

83. The optical communication system as set forth in claim 79, wherein the passive optical interface device isolates the optical receiver from the optical transmitter such that the optical transmitter and optical receiver can operate in full duplex mode.

84. A structure equipped with an optical system for communicating with at least one other system over a bi-directional optical bus, comprising:

the structure;

an optical transmitter contained within the structure for receiving a first set of electrical signals and for producing a first set of optical signals;

a passive optical interface device contained within the structure for being coupled to the optical bus for routing the first set of optical signals received from the optical transmitter onto the optical bus in both directions and for permitting optical signals already traveling along the optical bus to pass by in both directions;

an optical receiver contained within the structure for receiving a second set of optical signals traveling along the optical bus from the passive optical interface device and for generating a second set of electrical signals; and

an optical amplifier contained within the structure for performing bi-directional amplification of at least one of the first set and second set of optical signals;

wherein the optical amplifier is for compensating for at least some of the coupling losses associated with the passive optical interface device.

85. A method for communicating at a first node with a second node over a bi-directional optical bus, comprising:

generating a first set of electrical signals at the first node;

converting the first set of electrical signals into a first set of optical signals;

passively splitting the first set of optical communication signals into two components;

routing the two components of the first set of optical signals along the optical bus and permitting the optical signals already on the optical bus traveling in both directions to be passively routed pass the first node, the routing involving directing the two components of the first set of optical signals in opposite directions along the optical bus and combining the two components with any optical signals already on the optical bus;

passively diverting toward the first node, a second set of optical signals which are generated by the second node and which are on the bus traveling in both directions, wherein the diverting includes permitting at least some of the optical signals traveling in both directions to be passively routed pass the first node;

converting the second set of optical signals into a second set of electrical signals; and

amplifying the optical signals traveling in both directions between the first node and the second node, wherein the amplifying is performed passively and is for compensating for at least some of the losses associated with diverting the optical signals toward the first node.

REMARKS

This preliminary amendment is being submitted to present additional claims directed to patentable aspects of the invention. Claims 1 to 85 are now pending in the application with claims 19 to 85 being newly added. Support for the claims may be found in the original patent application; no new matter has been entered. If the Examiner has any comments or suggestions to place the application in even better form, such as to result in a Notice of Allowance, the Examiner is encouraged to telephone the undersigned attorney.

Please charge any additional fees or credit any overpayment to Deposit Account No. 11-0855.

Respectfully submitted,

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